## REMARKS/ARGUMENTS

Reconsideration of this application is requested. Claims 12-18 and 20-22 are in the case.

## I. THE OBVIOUSNESS REJECTIONS

Claims 12-19 stand rejected under 35 U.S.C. §103(a) as allegedly unpatentable over Murray (US 2003/0171206), in view of Jenkins III *et al.* (US 4,588,790 or 4,543,399) (Jenkins). Claim 17 is rejected under 35 U.S.C. §103(a) as allegedly unpatentable over Murray in view of Jenkins and further in view of Muhle *et al.* (US 6,180,736) (Muhle). Claims 19-20, and 22 are rejected under 35 U.S.C. §103(a) as allegedly unpatentable over Murray and further in view of Babb *et al.* (US 6,627,573) (Babb). Claim 21 is rejected under 35 U.S.C. §103(a) as allegedly unpatentable over Murray in view of Devore *et al.* (US 5,470,993) (Devore) and further in view of Babb. The rejections are respectfully traversed.

The claimed invention provides a process for the copolymerization of ethylene and an $\alpha$-olefin having 7 to 10 carbon atoms in a fluidized bed gas phase reactor in the presence of a single site polymerization catalyst which is a metallocene complex comprising a metal selected from titanium, zirconium or hafnium. The process comprises operating the process in condensed mode and wherein the partial pressure of the alpha-olefin in the reaction zone is maintained below an amount which would, at a temperature of $10^{O}$C less than the temperature of the monomer mixture in the reaction zone, be the saturated vapor pressure of said alpha-olefin to prevent condensation of said alpha olefin in the reaction zone.

The presently claimed process requires the use of a metallocene catalyst, as previously recited in claim 19. Claim 19 has accordingly been canceled without prejudice. In order to yet further distinguish over Murray, the metallocene complex is defined as comprising the metals titanium, zirconium or hafnium. Basis for this amendment appears at page 4 lines 10–14 of the specification.

It has surprisingly been discovered, according to the present invention, that in order to operate copolymerizations using higher $\alpha$-olefins as comonomers in condensed mode operation, it is advantageous to operate the process in the presence of a metallocene complex comprising a metal selected from titanium, zirconium or hafnium, such that the amount of the $\alpha$-olefin is maintained below that at which substantial condensation in the reactor occurs. In other words, according to the claimed process, the partial pressure of the alpha-olefin in the reaction zone is maintained below an amount which would, at a temperature of 10$^{O}$C less than the temperature of the monomer mixture in the reaction zone, be the saturated vapor pressure of the alpha-olefin to prevent condensation of the alpha olefin in the reaction zone. The claimed process is operated under condensed mode of operation by use of, for example, a suitable inert substance in the recycle stream and under conditions such that the amount of the $\alpha$-olefin (e.g., octene) is maintained below that at which substantial condensation in the reactor occurs.

By use of the process conditions of the present invention, higher $\alpha$-olefins may be successfully employed in a gas phase process provided the amount of higher $\alpha$-olefin comonomer is maintained below that at which substantial condensation occurs. Such operation is also dependent upon the operation temperature and the boiling point

of the higher $\alpha$-olefin. The process is particularly advantageous when performed in the presence of a metallocene complex comprising a metal selected from titanium, zirconium or hafnium, as now claimed, which is able to incorporate high levels of comonomers at low comonomer inventories.

The Action states (page2) that the Murray catalysts may contain a metallocene complex (referring to [0054]). This is incorrect. While the R groups in Murray may include many different examples of ring ligands, none are cyclopentadienyl. Moreover, these are substituents on the general formula described in the formula described in [0040] which is clearly **not** a metallocene complex. At the top of page 4, ferrocene or chromcene structures are disclosed as suitable R groups but these must be read as part of the general formula in [0040].

As the Action correctly notes, Murray does not disclose operation in condensed mode. Murray only discloses that single site catalysts may be used for processes operating in the gas phase, one of which may be a fluidized bed process in which a recycle stream is used to return gas to the reactor to maintain the fluidized bed. However, there is no disclosure or suggestion in Murray of the use of metallocene complexes in the process described therein which does not suggest operation in condensed mode, nor the polymerization of ethylene and higher alpha-olefins, nor the partial pressures required by amended claim 12.

Murray is therefore deficient in 4 areas with respect to the process as claimed, namely:

1. no metallocene complex having titanium, zirconium or hafnium metals;
2. no operation in condensed mode;

3. no specific teaching of higher alpha-olefins;

4. no specific teaching of partial pressures.

Murray clearly does not give rise to a *prima facie* case of obviousness of the presently claimed process.

The above-discussed deficiencies of Murray are not cured by the cited secondary art. The Jenkins references are directed to polymerization in condensed mode. The Action asserts that it would be obvious to operate the process of Murray in condensed mode as Murray actually refers to the Jenkins references. This is not correct.

Murray refers to many polymerization processes in [0121], including US 4,588,790 and US 4,543,399, but there is no specific direction in Murray to these particular references. The disclosure in [0121] merely represents those types of fluidized bed processes known at the time. In any event, the Murray disclosure is directed to different catalyst systems to those now recited in the presently claimed process.

With respect to the types of comonomers used in Murray, at [0115] a list is disclosed, but this is merely a list of those comonomers known to be typically used in such copolymerization processes. 1-octene and 1-decene are included but only as examples of suitable comonomers having 2-12 carbon atoms. This is a list commonly found in references generally disclosing ethylene copolymerization. All the examples in Murray use 1-hexene as the comonomer. One of ordinary skill would not have been motivated based on Murray to use the higher alpha olefins.

The Action goes into detail regarding the mole ratios of ethylene and comonomer. The ratios disclosed in [0119] are very general and relate to broad ratios.

There is no suggestion of the much narrower and specific ratios as claimed in present claims 15 and 17. As noted in the prior response, present claim 15 defines this ratio for octene as comonomer as 0.0001 to 0.02, and claim 17 for decene as 0.00005 – 0.005. It is clear that the proposed ranges for the present invention may be much lower than the general ranges described in Murray. In addition, there is no specific indication in Murray as to suitable ranges for the higher comonomers such as octene or decene.

Even if all of the above options were chosen by the skilled person from a reading of Murray (it is believed this would not have occurred), there is still no suggestion in Murray of the metallocene complex having titanium, zirconium or hafnium metals, nor of the feature that "the amount of alpha-olefin is maintained below that at which substantial condensation occurs".

The Action asserts that it would be obvious to arrive at the claimed process from Murray since it is considered that the Murray processes "in condensed mode" would be inherently devoid of "substantial condensation" and that this is because the amount of comonomer is controlled by the temperature and partial pressure in the reaction zone. While the level of condensation is controlled by these factors, the important point is that the skilled person must first have recognized that the level of condensation should be maintained below that at which substantial condensation occurs (or rather the partial pressure /temperature amendment) in order to achieve the advantages of the present invention. This would not have occurred to one of ordinary skill as of the filing date of the present case. Withdrawal of the obviousness rejection of claims 12-19 over Murray in view of Jenkins (US 4,588,790 or 4,543,399) is respectfully requested.

Dependent claim 17 is rejected over the Murray and Jenkins in view of Muhle. The deficiencies of Murray and Jenkins are discussed above. With regard to Muhle, there is no specific disclosure in this reference of higher alpha olefins. The Action takes the disclosure of Muhle (as with Murray and Jenkins) and generalizes to the specific higher alpha-olefins of the present invention. That the present invention is directed to these higher alpha-olefins is a distinguishing feature over the cited art. This is particularly the case now that the claims are amended to the control of the polymerization process.

None of Murray, Jenkins and Muhle is directed to or highlights the copolymerization of ethylene and higher alpha olefins having 7 to 10 carbon atoms. Some may disclose 1-octene and 1-decene but this is merely as examples of suitable comonomers from a long list. This is a key point with regard to the present invention **together** with the use of metallocene complexes having titanium, zirconium or hafnium metals. Withdrawal of the obviousness rejection of claim 17 over Murray in view of Jenkins and further in view of Muhle is respectfully requested.

Claims 19-20 and 22 are rejected over the combination of Murray and US 5470993 (Devore) or US 6627573 (Babb). Claim 21 is rejected over Murray in view of Devore and further in view of Babb. The rejections are respectfully traversed.

Murray is irrelevant for the reasons discussed above. With respect to Devore, this reference discloses similar catalysts to those of the present invention and their potential use in the gas phase (col. 19). However, the catalysts are described in general terms as suitable in all types of polymerization processes – solution, suspension, slurry and gas phase. Examples 33-39 are performed in the gas phase but

this is not operated in a condensed mode process. There is no indication in Devore of the suitability of the catalysts for gas phase polymerization in condensed mode operation.

With regard to Babb, the Action refers to the disclosure of higher alpha-olefins in Babb at col. 22, lines 14 -18. This is even less of a disclosure of higher alpha-olefins than in Devore. Babb specifically discloses 1-butene, 1-hexene and 4-methyl-1 pentene, but **none** of these meets the requirement of higher alpha olefins having 7 to 10 carbon atoms.

As noted earlier, the subject matter of claim 19 is incorporated into claim 12 to define the catalyst as a metallocene complex. Babb describes metallocene complexes at cols. 12 – 19, but none of the other features of the claims are disclosed in any direct disclosure in Babb or in Devore. Withdrawal of the rejections of Claims 19-22 over Murray in view of Babb, or over Murray in view of Devore in view of Babb, is respectfully requested.

In summary, Murray, taken alone or in combination with the cited secondary art, does **not** suggest operation in condensed mode of a process for the copolymerisation of ethylene and an $\alpha$-olefin having 7 to 10 carbon atoms in a fluidised bed gas phase reactor in the presence of a single site polymerisation catalyst which is a metallocene complex comprising a metal selected from titanium, zirconium or hafnium. Withdrawal of the obviousness rejections is respectfully requested.

## II. AMENDMENTS

Claim 12 has been amended by limitation to a metallocene catalyst as previously claimed in claim 19 and further specifying the presence of metals titanium, zirconium or hafnium. Basis for such metals appears at page 4 lines 10-14 of the originally-filed specification. No new matter is entered, the number of claims has been reduced, and no issues are raised. Entry and favorable consideration of the amended claims at this stage of prosecution are respectfully requested.

Favorable action is awaited.

Respectfully submitted,

**NIXON & VANDERHYE P.C.**

By: /Leonard C. Mitchard/
Leonard C. Mitchard
Reg. No. 29,009

LCM:lff
901 North Glebe Road, 11th Floor
Arlington, VA 22203-1808
Telephone: (703) 816-4000
Facsimile: (703) 816-4100